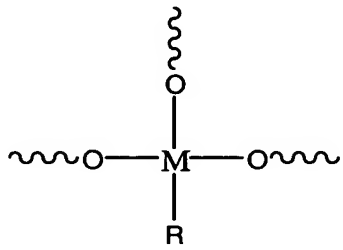
WHAT IS CLAIMED IS:

[C001] 1. A polycyclic or monocyclic perfluorovinyl compound comprising at least one structural unit selected from the group consisting of formula I and formula II



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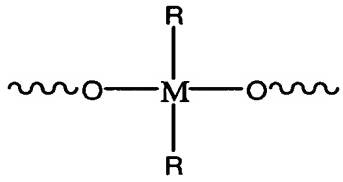


II

wherein M is independently at each occurrence a metal selected from group 14 of the periodic table of the elements; and

R is independently at each occurrence a bond, a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group;

said polycyclic or monocyclic compound comprising at least two perfluorovinyl groups.

[C002] 2. The perfluorovinyl compound according to claim 1 wherein said aliphatic group is an alkyl group, an alkoxy group, a perhaloalkyl group, a partially halogenated alkyl group.

[C003] 3. The perfluorovinyl compound according to claim 1 wherein said aromatic group is an aryl group, an aryloxy group, a perhaloaromatic group, or a partially halogenated aromatic group.

[C004] 4. The perfluorovinyl compound according to claim 1 having formula III

$$[RSiO_{3/2}]_n$$

III

wherein R is independently at each occurrence a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group; and
n is a number from 2 to about 1000.

[C005] 5. The perfluorovinyl compound according to claim 1 having formula IV

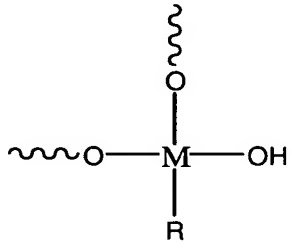
$$[R_2SiO]_n$$

IV

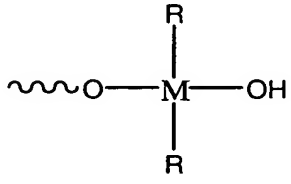
wherein R is independently at each occurrence a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group; and

n is a number from 2 to about 1000.

[C006] 6. The monocyclic or polycyclic perfluorovinyl compound according to claim 1 further comprising structural units selected from the group consisting of formula V and formula VI



V



VI

wherein M is independently at each occurrence a metal selected from group 14 of the periodic table of the elements; and

R is independently at each occurrence a bond, a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group.

[C007] 7. The monocyclic or polycyclic perfluorovinyl compound according to Claim 1, wherein said M comprises at least one of silicon and germanium.

[C008] 8. The monocyclic or polycyclic perfluorovinyl compound according to Claim 1, wherein said monocyclic or polycyclic perfluorovinyl compound comprises a silicon–oxygen network.

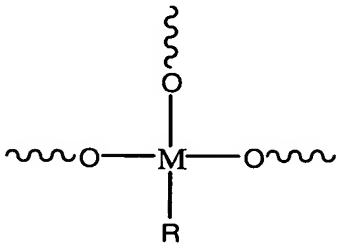
[C009] 9. The monocyclic or polycyclic perfluorovinyl compound according to claim 8, wherein said silicon–oxygen network comprises an oligomeric silsesquioxane.

[C010] 10. The monocyclic or polycyclic perfluorovinyl compound according to Claim 9, wherein said oligosilsesquioxane comprises a polyhedral oligomeric silsesquioxane.

[C011] 11. The monocyclic or polycyclic perfluorovinyl compound according to Claim 10, wherein said polyhedral oligomeric silsesquioxane comprises an octahedral structure.

[C012] 12. A method of forming an optical film, said method comprising:

(a) providing a blend of monomer A and monomer B, said monomer A comprising a polycyclic or monocyclic perfluorovinyl compound comprising at least one structural unit selected from the group consisting of formula I and formula II



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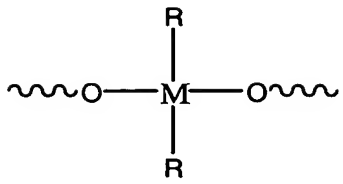


II

wherein M is independently at each occurrence a metal selected from group 14 of the periodic table of the elements,

R is independently at each occurrence a bond, a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group; said polycyclic or monocyclic compound comprising at least two perfluorovinyl groups,

said monomer B being an organic compound comprising at least two CF_2=CF– units;

(b) mixing said blend with a photo-initiator and a photo-curable monomer C, wherein said photo-curable monomer C comprises at least one of an acrylate, an epoxy, a polyimide, a silicone, a vinyl compound, a carbonate, and a diene, to yield a mixed blend;

(c) partially polymerizing at least one of the blend and the mixed blend;

(d) depositing said mixed blend on a substrate to form a film;

(e) selectively exposing said film to radiation to at least partially polymerize monomer C; and

(f) curing said film.

[C013] 13. The method according to Claim 12, wherein said M comprises at least one of silicon and germanium.

[C014] 14. The method according to claim 12 wherein said polycyclic or monocyclic perfluorovinyl compound comprises a silicon-oxygen network.

[C015] 15. The method according to claim 14 wherein said silicon-oxygen network comprises an oligomeric silsesquioxane.

[C016] 16. The method according to Claim 15, wherein said oligomeric silsesquioxane comprises a polyhedral oligosilsesquioxane.

[C017] 17. The method according to Claim 16, wherein said polyhedral oligomeric silsesquioxane comprises an octahedral structure.

[C018] 18. The method according to Claim 12, wherein said monomer B further comprises $CF_2 = CF—X_m–R–X_m—CF=CF_2$ wherein

X is independently at each occurrence a bond, an oxygen linkage, an amine linkage, a sulfur linkage, a silicon-containing linkage, an aliphatic group, a cycloaliphatic group, or an aromatic group,

m is independently at each occurrence an integer from 0 to about 100, and

R is a bond, an aliphatic group, a cycloaliphatic group, or an aromatic group.

[C019] 19. The method according to claim 18 wherein X comprises at least one O, N, S, Si, $-CH_2–$, $-CF_2–$, $-CR_2–$, alkyl group, alkoxy group, partially halogenated aliphatic group, or fully halogenated aliphatic group, wherein R is a bond, an aliphatic group, a cycloaliphatic group, or an aromatic group.

[C020] 20. The method according to Claim 12, wherein (c) comprises the partial polymerization of the blend of monomers A and B, said partial polymerizing being carried out prior to formation of the mixed blend.

[C021] 21. The method according to Claim 12, wherein said curing in (f) is carried out by at least one of heat radiation, light exposure and combinations thereof.

[C022] 22. The method according to Claim 12, wherein (c) comprises heating said blend for between about 2 minutes and about 60 minutes at a temperature between about 100°C and about 200°C.

[C023] 23. The method according to Claim 12, wherein (e) further comprises diffusing monomer C from an unexposed area into an exposed area of said film after selectively exposing said film to radiation.

[C024] 24. The method according to claim 23 wherein selectively exposing and diffusing are performed to generate a desired contrast in index of refraction between exposed and unexposed areas of said film.

[C025] 25. The method according to Claim 12, wherein said mixed blend has a viscosity of about 10 cSt to about 10,000 cSt.

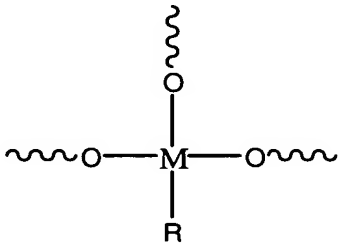
[C026] 26. The method according to Claim 12, wherein said mixed blend is deposited on a substrate using a technique comprising at least one of spin-coating, doctor blading, dip-coating, casting, extrusion and combinations thereof.

[C027] 27. The method according to Claim 12, wherein step (e) further comprises exposing said film to radiation using a photo-mask.

[C028] 28. The method according to Claim 21, wherein said curing comprises heating to a temperature of about 150°C to about 300°C.

[C029] 29. An electro-optical device comprising:

a polymer fabricated from a polycyclic or monocyclic perfluorovinyl compound comprising at least one structural unit selected from the group consisting of formula I and formula II



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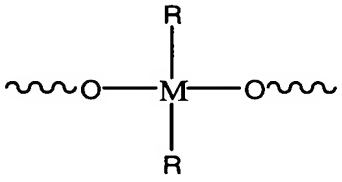


II

wherein M is independently at each occurrence a metal selected from group 14 of the periodic table of the elements; and

R is independently at each occurrence a bond, a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group;
said polycyclic or monocyclic compound comprising at least two perfluorovinyl groups.

[C030] 30. The electro-optical device according to Claim 29, wherein said electro-active component comprises at least one of an organic light-emitting diode, a photovoltaic cell, a light emitting diode, an electro-luminescent material, a cathodoluminescent material, a phosphorescent material, a mirror, a laser, an optical fiber, a MEMS device, a device for concentrating or dissipating light, a splitter, and combinations thereof.

[C031] 31. The electro-optical device according to Claim 29, wherein said electro-optical device is configured to be exercisable by a power source.

[C032] 32. The electro-optical device according to Claim 29, wherein said M comprises at least one of silicon and germanium.

[C033] 33. The electro-optical device according to Claim 29, wherein said polycyclic or monocyclic perfluorovinyl compound comprises a silicon-oxygen network.

[C034] 34. The electro-optical device according to Claim 33, wherein said silicon-oxygen network comprises an oligomeric silsesquioxane.

[C035] 35. The electro-optical device according to Claim 34, wherein said oligomeric silsesquioxane comprises a polyhedral oligomeric silsesquioxane.

[C036] 36. The electro-optical device according to Claim 35, wherein said polyhedral oligomeric silsesquioxane comprises an octahedral structure.

[C037] 37. The electro-optical device according to Claim 29, wherein said polymer is an optical material.

[C038] 38. The electro-optical device according to Claim 37, wherein said optical material comprises an optically graded material.

[C039] 39. The electro-optical device according to Claim 38, wherein said optically graded material has a refractive index between about 1.0 and about 2.42.

[C040] 40. The electro-optical device according to Claim 38, wherein said optically graded material has an optical loss below about 0.05 dB/cm in the wavelength range from about 600 nm to about 1600 nm.

[C041] 41. The electro-optical device according to Claim 40, wherein said optical loss is below about 0.05 db/cm at wavelengths of about 850 nm, 1310 nm and 1550 nm.

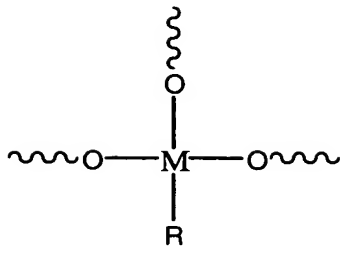
[C042] 42. The electro-optical device according to Claim 29, further comprising a substrate supporting said electro-optical component and said polymer, wherein said polymer has high adhesion to a substrate of better than class 3B as measured by American Standard Test Method (ASTM) D3359.

[C043] 43. The electro-optical device according to Claim 42, wherein said substrate comprises at least one of a metal, ceramic, glass, plastic, organic material, inorganic material, semiconductor, electronic device, microelectromechanical system (MEMS) device, sensor, refractive index modulating device, and combinations thereof.

[C044] 44. The electro-optical device according to Claim 29, wherein said polymer has high thermal stability up to a temperature of about 250°C.

[C045] 45. A polymer prepared by reacting components (a), (b) and (c) wherein:

component (a) is a blend of monomer A and monomer B, said monomer A comprising a polycyclic or monocyclic perfluorovinyl compound comprising at least one structural unit selected from the group consisting of formula I and formula II



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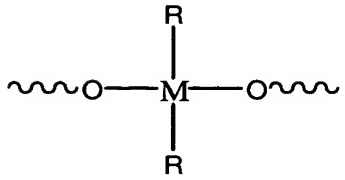

II

wherein M is independently at each occurrence a metal selected from group 14 of the periodic table of the elements,

R is independently at each occurrence a bond, a hydrogen, an aliphatic group, a cycloaliphatic group, or an aromatic group; said polycyclic or monocyclic compound comprising at least two perfluorovinyl groups,

said monomer B being an organic compound comprising at least two CF_2=CF– units; and

component (b) is at least one photo-curable monomer C, wherein said photo-curable monomer comprises at least one of an acrylate, an epoxy, a polyimide, a silicone, a vinyl, a carbonate, a diene; and

component (c) is at least one photo-initiator.

[C046] 46. The polymer according to Claim 45, wherein said photo-initiator comprises at least one of dibromoethane, benzophenone, benzyl dimethyl ketal, 2-hydroxy-2-methylphenylpropane-1-one, 1-hydroxycyclohexylphenyl ketone, 2-methyl-1-[4-(methylthio)phenyl]-2-morpholino-propan-1-one, phenylbis(2,4,6-trimethylbenzoyl)phosphine oxide, N-hydroxyphthalimide triflate, (4-benzoylbenzyl)trimethylammonium chloride, benzoin methyl ether, and diphenyliodonium hexafluorophosphate.

[C047] 47. The polymer according to Claim 45, wherein said M comprises at least one of silicon and germanium.

[C048] 48. The polymer according to claim 45 wherein said polycyclic or monocyclicperfluorovinyl compound comprises a silicon-oxygen network.

[C049] 49. The polymer according to Claim 48, wherein said silicon-oxygen network comprises an oligomeric silsesquioxane.

[C050] 50. The polymer according to Claim 49, wherein said oligomeric silsesquioxane comprises a polyhedral oligomeric silsesquioxane.

[C051] 51. The polymer according to Claim 50, wherein said polyhedral oligomeric silsesquioxane comprises an octahedral structure.

[C052] 52. The polymer according to claim 45 which is an optical material said material being a photo-definable cladding system.

[C053] 53. The polymer according to Claim 52, wherein said optical material comprises an optically graded material.

[C054] 54. The polymer according to Claim 53, wherein said optically graded material has a refractive index between about 1.0 and about 2.42.

[C055] 55. The polymer according to Claim 53, wherein said optically graded material has an optical loss below about 0.05 dB/cm in the wavelength from about 600 nm to about 1600 nm.

[C056] 56. The polymer according to Claim 55, wherein said optical loss is below about 0.05 db/cm at wavelengths of about 850 nm, 1310 nm and 1550 nm.

[C057] 57. The polymer according to Claim 45, wherein said polymer has high adhesion to a substrate of better than class 3B as measured by American Standard Test Method (ASTM) D3359.

[C058] 58. The polymer according to Claim 57, wherein said substrate comprises at least one of a metal, ceramic, glass, plastic, organic material, inorganic material, semiconductor, electronic device, microelectromechanical system (MEMS) device, sensor, refractive index modulating device, and combinations thereof.

[C059] 59. The polymer according to Claim 45, wherein said polymer is a flame retardant.

[C060] 60. The polymer according to Claim 45, wherein said polymer has high thermal stability up a temperature of about 250°C.

[C061] 61. The polymer according to Claim 45, wherein said monomer B comprises at least one of 1,6-di(trifluorovinyl)dodecafluorohexane, 4,4'-bis(4-trifluorovinyl)oxy)biphenyl, 1,1,1-tris(4-trifluorovinyloxyphenyl)ethane, bis(4-trifluorovinyl)oxy)perfluorobiphenyl, and combinations thereof.

[C062] 62. The polymer according to Claim 45, wherein said polymer has a viscosity of about 10 cSt to about 10,000 cSt.